IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s) : James A. BRUCE et al.	Group Art Unit: 2625
Appln. No. : 09/683,836	Examiner: Strege, John
Filed : February 21, 2002	Confirmation No.: 9685
For : MASK DEFECT ANALYSIS SYSTEM	

Commissioner for Patents
U.S. Patent and Trademark Office
Customer Service Window, Mail Stop <u>Amendment</u>
Randolph Building
401 Dulany Street
Alexandria, VA 22314

<u>REQUEST FOR RECONSIDERATION UNDER 37 C.F.R. §1.111</u>

Sir:

In response to the Office Action dated December 8, 2005, please reconsider the rejected claims based upon the following remarks.

Remarks begin on page 2.

If extensions of time are necessary to prevent abandonment of this application, then such extensions of time are hereby petitioned under 37 C.F.R. §1.136(a), and any fees required therefor (including fees for net addition of claims) are hereby authorized to be charged to Deposit Account No. 09-0456.

REMARKS

Claims 1-20 and 36 are currently pending in the application. No claims are amended, added, or canceled by this response. Reconsideration of the rejected claims in view of the following remarks is respectfully requested.

35 U.S.C. §103 Rejection

Claims 1-2, 4-5, 8, 11-20, and 36 were rejected under 35 U.S.C. §103(a) for being unpatentable over U. S. Patent No. 6,873,720 issued to Cai *et al.* ("Cai") in view of U. S. Patent No. 6,366,687 issued to Aloni *et al.* ("Aloni"). Claims 3, 6, and 9-10 were rejected under 35 U.S.C. §103(a) for being unpatentable over Cai in view of Aloni and further in view of U. S. Patent No. 6,757,645 issued to Chang *et al.* ("Chang"). Claim 7 was rejected under 35 U.S.C. §103(a) for being unpatentable over Cai in view of Aloni in view of Chang and further in view of U. S. Patent No. 5,965,306 issued to Mansfield *et al.* ("Mansfield"). These rejections are respectfully traversed.

Claims 1-2, 4-5, 8, 11-20, and 36

In this rejection, the Examiner is of the opinion that it would have been obvious to the skilled artisan to combine Cai and Aloni, and that the resulting combination shows all of the features of the claimed invention. Applicants respectfully disagree and submit that the Examiner has failed to establish a *prima facie* case of obviousness.

The Examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP §2142.

The present invention generally relates to the field of semiconductor manufacturing, and, more particularly, to a method for automating the evaluation and

2

analysis of defects in masks used in the semiconductor manufacturing process to determine which defects would cause product failure. Independent claims 1, 11, 16, and 19 all recite modifying design data according to defect inspection data and determining a final disposition by applying different acceptance rules to the critical defects and the non-critical defects. For example, claim 1 recites, in pertinent part:

> ...modifying said design data for the component according to said defect inspection data; ...
> determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects.

The Examiner asserts that Cai shows all of the features of the claimed invention, but admits that "Cai does not explicitly disclose that the design data comes from a design data repository". Applicants agree that Cai does not teach or suggest this feature. Moreover, Applicants submit that Cai does not contain the features of the claimed invention as suggested by the Examiner, and that Aloni does not compensate for the deficiencies of Cai.

The Examiner asserts that Cai discloses modifying said design data for the component according to said defect inspection data. Specifically, the Examiner is of the opinion that Cai's formation of a simulated wafer image in numeral 511 based on the reference mask and the defect data constitutes modifying as recited in the claimed invention. The Examiner also asserts that Cai discloses determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects. Specifically, the Examiner is of the opinion that Cai's tolerances constitute different acceptance rules as recited in the claimed invention. Applicants respectfully disagree with this characterization of Cai.

Contrary to the Examiner's assertion, Cai does not show modifying the design data according to the defect inspection data as recited in the claimed invention. Instead, Cai shows analyzing a physical mask 501A and a reference mask 501B with an inspection tool 502. The data from the inspection tool is supplied to the image simulator 511. The image simulator 511 generates simulations of the image data for the physical mask 501A and the reference mask 501B. These simulations are referenced as wafer

3

image (Phy) 517A and wafer image (Ref) 517B (cols. 10-11). The wafer image (Phy) 517A and wafer image (Ref) 517B are subsequently aligned (col. 13, lines 11-16) and analyzed for differences (col. 13, lines 11-36) to find defects. More specifically, the image simulator 511 keeps the data regarding the physical mask 501A and reference mask 501B separate so that the two images 517A and 517B can later be overlapped to identify defects. But there is no mention of modifying the design data according to the defect inspection data. In fact, Cai only shows overlapping the physical data to show a defect, with no correction or modification of the design data. Applicants submit that if Cai's design data were modified according to the defect data, as suggested by the Examiner, then the two images would not reveal any differences when overlapped. Therefore, Cai does not show modifying the design data according to the defect inspection data as recited in claim in the claimed invention.

Further contrary to the Examiner's assertion, Cai does not disclose determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects as recited in the claimed invention. Instead, Cai discloses the use of a single acceptance rule that applies to all defects. For example, Cai teaches that each individual defect has a numerical tolerance (TCD) associated with it based upon its location in the mask. Defects in more critical areas have a higher TCD value and defects in less critical areas have a lower TCD value. But regardless of the TCD value, each assigned TCD is a variable in an equation that produces a defect severity score (DSS). Based upon the DSS, the entire mask is either accepted, repaired, or scrapped (col. 5, lines 21-58; col. 13 – col. 18). Thus the DSS is an acceptance rule; whereas, the TCD, on the other hand, is a numerical measure of the criticality of a single defect. Thus, an individual defect is not accepted or rejected based upon its TCD. Instead, all of the TCD's factor into the calculation of the DSS, which is *the single acceptance rule* for the mask. Therefore, Cai does not teach or suggest determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defect as recited in the claimed invention.

Aloni does not compensate for the deficiencies of Cai. Aloni discloses a data converter apparatus and method for a database-to-object inspection system. In Aloni an optical inspection system is used for inspecting masks that uses a database

4

containing design data corresponding to a reference. Aloni does not, however, teach or suggest: modifying the design data according to the defect inspection data, or determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects as recited in the claimed invention. Furthermore, neither Cai nor Aloni teach a method for the evaluation and analysis of defects in masks to determine whether a defect of the observed size, shape, and location will print on the wafer and cause a circuit malfunction. Thus it can be seen that Cai and Aloni, alone or in combination, do not teach or suggest every element of the claimed invention. Therefore, the Examiner has failed to establish a *prima facie* case of obviousness.

Claim 36

Applicants note that in rejecting claim 36, the Examiner asserted "Claim 36 is similar to claim 1 thus it is similarly analyzed and rejected." Applicants respectfully disagree.

Claim 36 recites features that are not recited in claim 1. For example claim 36 recites, in pertinent part:

> ...generating shapes representing the defects;...and
> performing an analysis using the design data, the generated shapes, and a predetermined rule set to determine whether the defects are critical defects and non-critical defects...

Claim 1 does not recite generating shapes representing the defects. Claim 1 does not recite performing an analysis using, *inter alia*, the generated shapes. Contrary to the Examiner's assertion, claim 36 recites features that are not recited in claim 1. Thus, the rejection of claim 36 is improper because the Examiner has not addressed every element of the claim.

Applicants submit that neither Cai nor Aloni teaches generating shapes representing the defects, or performing an analysis using the generated shapes as recited in claim 36.

In any event, claim 36 recites that a final disposition of the component is determined by applying different acceptance rules to the critical defects and the non-critical defects. As described above, Cai and Aloni do not teach or suggest this feature. Therefore, the applied references do not teach all of the features of claim 36.

Dependent claims

As to dependent claims 2, 4, 5, 8, 12-15, 17, 18, and 20, Applicants submit that these claims are dependent on an allowable independent claim and therefore are allowable by virtue of the allowability of the independent claim.

Accordingly, Applicants respectfully request that the rejection over claims 1-2, 4-5, 8, 11-20, and 36 be withdrawn.

Claims 3, 6 and 9-10

In this rejection, the Examiner is of the opinion that it would have been obvious to the skilled artisan to combine the Cai, Aloni, and Chang, and that the resulting combination shows all of the features of the claimed invention. Applicants respectfully disagree and submit that the Examiner has failed to establish a *prima facie* case of obviousness.

Claims 3, 6, and 9-10 depend from allowable independent claim 1. As described above, Cai and Aloni do not teach or suggest all of the features of claim 1. Chang does not compensate for the deficiencies of Cai and Aloni with respect to claim 1. The applied references, alone or in combination, do not teach all of the features of the claims.

Further regarding claim 9, Applicants submit that, contrary to the Examiner's assertion, Chang does not teach generating a representative defect shape for each mask layer being inspected corresponding to defects from said defect inspection data, as recited in claim 9. The Examiner states that Chang discloses that the image simulator 960 simulates a defect shape for the mask layer being inspected corresponding to defects from said defect detection processor 925. Applicants respectfully disagree.

6

Instead, Chang discloses that the design image simulator 960 generates a simulated design stepper image 975 (FIG. 9 and lines 65-67 of col. 20). Chang clearly shows in FIG. 9 that the design stepper image 975 does not contain shapes corresponding to defects. Thus, the Examiner's assertion that the image simulator 960 simulates defect shapes is erroneous. Therefore, the rejection is improper because the Examiner has failed to identify all of the recited elements of the claimed invention in the applied references.

Accordingly, Applicants respectfully request that the rejection over claims 3, 6 and 9-10 be withdrawn.

Claim 7

In this rejection, the Examiner is of the opinion that it would have been obvious to the skilled artisan to combine the Cai, Aloni, Chang and Mansfield, and that the resulting combination shows all of the features of the claimed invention. Applicants respectfully disagree and submit that the Examiner has failed to establish a _prima facie_ case of obviousness.
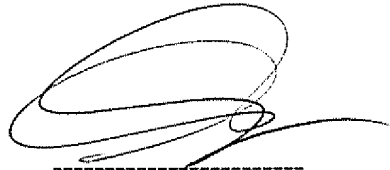
Claim 7 depends indirectly from allowable independent claim 1. As described above, Cai, Aloni, and Chang do not teach or suggest all of the features of claim 1. Mansfield does not compensate for the deficiencies of Cai, Aloni, and Chang with respect to claim 1. The applied references, alone or in combination, do not teach all of the features of the claims.

Accordingly, Applicants respectfully request that the rejection over claim 7 be withdrawn.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicants hereby make a written conditional petition for extension of time, if required. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 09-0456.

Respectfully submitted,
James A. BRUCE

Andrew M. Calderon
Reg. No. 38,093

March 7, 2006
GREENBLUM & BERNSTEIN, P.L.C.
1950 Roland Clarke Place
Reston, VA 20191
(703) 716-1191